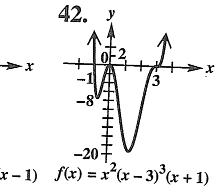
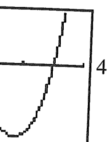
42.

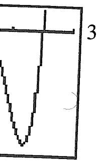


x − 1)

−2 < 0; f(3) = 1 > 0
−2 < 0; f(2) = 6 > 0
> 0; f(1) = −1 < 0
> 0; f(2.5) =
7. f(1) = −6 < 0;
0 48. f(.5) =
f(1) = −1 < 0
−3.8144 < 0;
91 > 0
−2.8699 < 0;
96 > 0
−35 < 0;
)
= −.73248 < 0;
263 > 0
(x + 6) ·
) or $f(x) = \frac{1}{2}x^3 -$
30
x − 3)²(x + 5) or
$\frac{1}{5}x^2 - \frac{21}{5}x + 9$
−14.21875
3)(x + 2)



21.16699
)(x + 3)²



56. $f(x) = x^5 + 2x^3 - 2x^2 + 5x + 5$; no real zero less than -1

57. $f(x) = 3x^4 + 2x^3 - 4x^2 + x - 1$; no real zero greater than 1

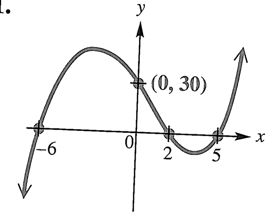
58. $f(x) = 3x^4 + 2x^3 - 4x^2 + x - 1$; no real zero less than -2

59. $f(x) = x^5 - 3x^3 + x + 2$; no real zero greater than 2

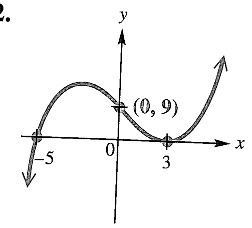
60. $f(x) = x^5 - 3x^3 + x + 2$; no real zero less than -3

Concept Check *In Exercises 61 and 62, find a cubic polynomial having the graph shown.*

61.



62.



Use a graphing calculator to graph the function defined by f(x) in the viewing window specified. Compare the graph to the one shown in the answer section of this text. Then use the graph to find f(1.25).

63. $f(x) = 2x(x - 3)(x + 2)$; window: $[-3, 4]$ by $[-20, 12]$
Compare to Exercise 31.

64. $f(x) = x^2(x - 2)(x + 3)^2$; window: $[-4, 3]$ by $[-24, 4]$
Compare to Exercise 33.

65. $f(x) = (3x - 1)(x + 2)^2$; window: $[-4, 2]$ by $[-15, 15]$
Compare to Exercise 35.

66. $f(x) = x^3 + 5x^2 - x - 5$; window: $[-6, 2]$ by $[-30, 30]$
Compare to Exercise 37.

Use a graphing calculator to approximate the real zero discussed in each specified exercise. See Example 7.

67. Exercise 43 **68.** Exercise 45 **69.** Exercise 47 **70.** Exercise 46

For the given polynomial function, approximate each zero as a decimal to the nearest tenth. See Example 7.

71. $f(x) = x^3 + 3x^2 - 2x - 6$

72. $f(x) = x^3 - 3x + 3$

73. $f(x) = -2x^4 - x^2 + x + 5$

74. $f(x) = -x^4 + 2x^3 + 3x^2 + 6$

Use a graphing calculator to find the coordinates of the turning points of the graph of each polynomial function in the given domain interval. Give answers to the nearest hundredth.

75. $f(x) = x^3 + 4x^2 - 8x - 8$; $[-3.8, -3]$

76. $f(x) = x^3 + 4x^2 - 8x - 8$; $[.3, 1]$

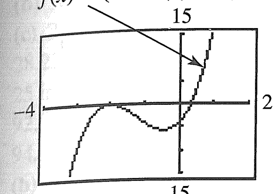
77. $f(x) = 2x^3 - 5x^2 - x + 1$; $[-1, 0]$

78. $f(x) = 2x^3 - 5x^2 - x + 1$; $[1.4, 2]$

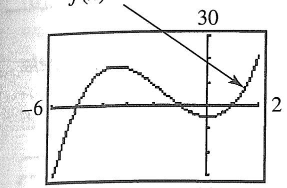
79. $f(x) = x^4 - 7x^3 + 13x^2 + 6x - 28$; $[-1, 0]$

80. $f(x) = x^3 - x + 3$; $[-1, 0]$

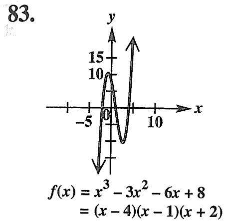
65. $f(1.25) = 29.046875$



66. $f(1.25) = 3.515625$

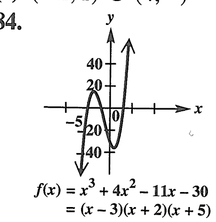


67. 2.7807764 **68.** .88993856
69. 1.543689 **70.** 2.193325
71. −3.0, −1.4, 1.4 **72.** −2.1
73. −1.1, 1.2 **74.** −1.5, 3.1
75. (−3.44, 26.15)
76. (.77, −11.33)
77. (−.09, 1.05) **78.** (1.76, −5.34)
79. (−.20, −28.62)
80. (−.58, 3.38) **81.** Answers will vary. **82.** 1 − *i* and 1 + *i*
83.



(a) {−2, 1, 4}
(b) (−∞, −2) ∪ (1, 4)
(c) (−2, 1) ∪ (4, ∞)

84.



(a) {−5, −2, 3}
(b) (−∞, −5) ∪ (−2, 3)
(c) (−5, −2) ∪ (3, ∞)

81. *(Modeling) Social Security Numbers* Your Social Security number (SSN) is unique, and with it you can construct your own personal Social Security polynomial. Let the polynomial function be defined as follows, where a_i represents the *i*th digit in your SSN:

$$\text{SSN}(x) = (x - a_1)(x + a_2)(x - a_3)(x + a_4)(x - a_5) \cdot (x + a_6)(x - a_7)(x + a_8)(x - a_9).$$

For example, if the SSN is 539-58-0954, the polynomial function is

$$\text{SSN}(x) = (x - 5)(x + 3)(x - 9)(x + 5)(x - 8)(x + 0)(x - 9)(x + 5)(x - 4).$$

A comprehensive graph of this function is shown in Figure A. In Figure B, we show a screen obtained by zooming in on the positive zeros, as the comprehensive graph does not show the local behavior well in this region. Use a graphing calculator to graph your own "personal polynomial."

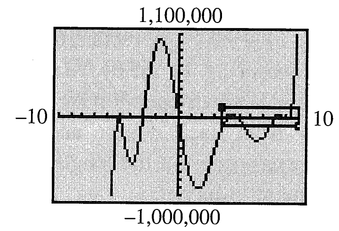


Figure A

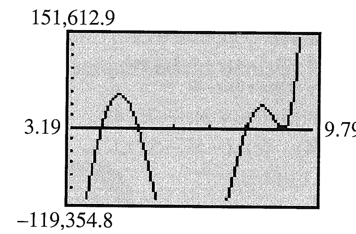
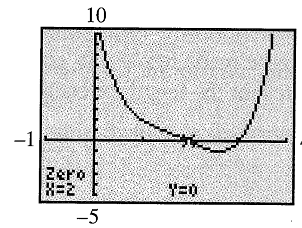
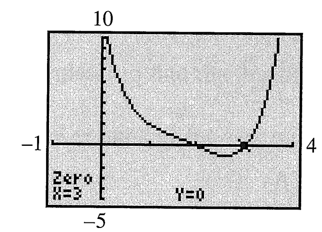


Figure B

82. A comprehensive graph of $f(x) = x^4 - 7x^3 + 18x^2 - 22x + 12$ is shown in the two screens, along with displays of the two real zeros. Find the two remaining nonreal complex zeros.





Relating Concepts

For individual or collaborative investigation
(Exercises 83–88)

For any function $y = f(x)$,

(a) the real solutions of $f(x) = 0$ are the *x*-intercepts of the graph;
(b) the real solutions of $f(x) < 0$ are the *x*-values for which the graph lies *below* the *x*-axis; and
(c) the real solutions of $f(x) > 0$ are the *x*-values for which the graph lies *above* the *x*-axis.

In Exercises 83–88, a polynomial function defined by f(x) is given in both expanded and factored forms. Graph the function, and solve the equations and inequalities. Give multiplicities of solutions when applicable.

83. $f(x) = x^3 - 3x^2 - 6x + 8$
$= (x - 4)(x - 1)(x + 2)$
(a) $f(x) = 0$ **(b)** $f(x) < 0$
(c) $f(x) > 0$

84. $f(x) = x^3 + 4x^2 - 11x - 30$
$= (x - 3)(x + 2)(x + 5)$
(a) $f(x) = 0$ **(b)** $f(x) < 0$
(c) $f(x) > 0$